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Callaway et al.

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(54) **COVERING SYSTEM FOR A BUILDING SUBSTRATE**

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(51) **Int. Cl.**

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E04B 1/68	(2006.01)
E04F 13/24	(2006.01)
E04F 15/02	(2006.01)
E04D 1/28	(2006.01)
E04D 1/34	(2006.01)

(52) **U.S. Cl.**
CPC ***E04B 1/64*** (2013.01); ***E04B 1/6812*** (2013.01); ***E04D 1/28*** (2013.01); ***E04D 1/34*** (2013.01); ***E04F 13/24*** (2013.01); ***E04F 15/02044*** (2013.01)

(58) **Field of Classification Search**
CPC E04B 1/64; E04B 1/6812; E04F 14/02044; E04F 13/24; E04D 1/34; E04D 1/28
See application file for complete search history.

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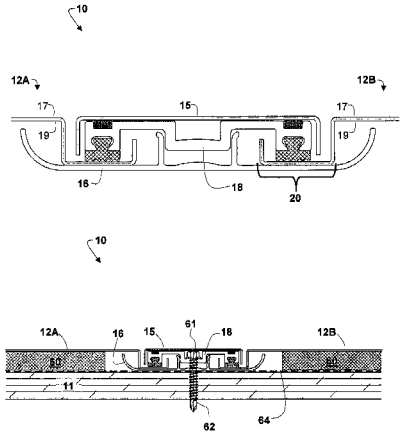
(57) **ABSTRACT**

A covering system for a building substrate is disclosed. The covering system comprises at least two panels having two opposite, gutter shaped joints, and a joint linking system comprising a cleat configured to accept the adjacent joints, a compression cap configured to bridge the adjacent joints, means for attaching the compression cap and cleat to the building substrate, and a cover cap configured to lie flush with the panels and conceal the compression cap and the attaching means. When assembled, the covering system forms a water-tight seal on and prevents water leakage into the building substrate. Further, the covering system provides hidden fasteners, an internal drainage channel which removes any moisture that migrates into the system, and joints which allow for expansion and contraction of the panels during assembly and in the course of environmental changes once installed.

20 Claims, 19 Drawing Sheets



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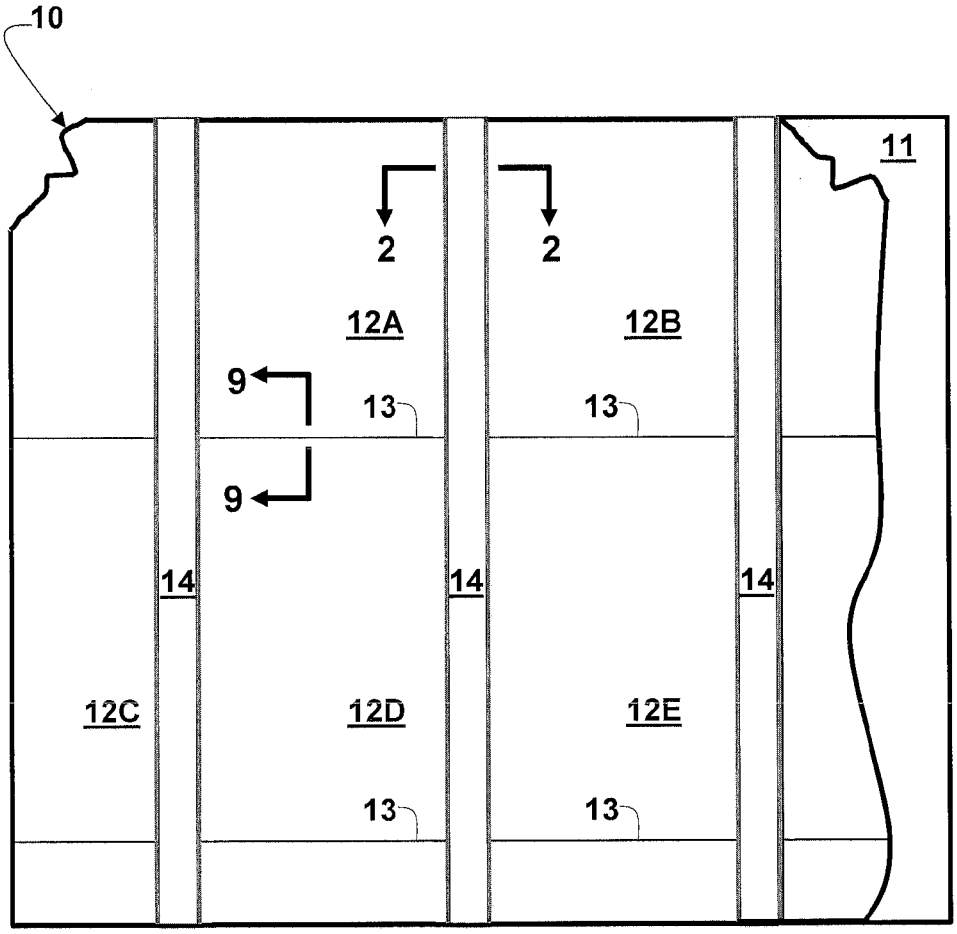

FIG. 1

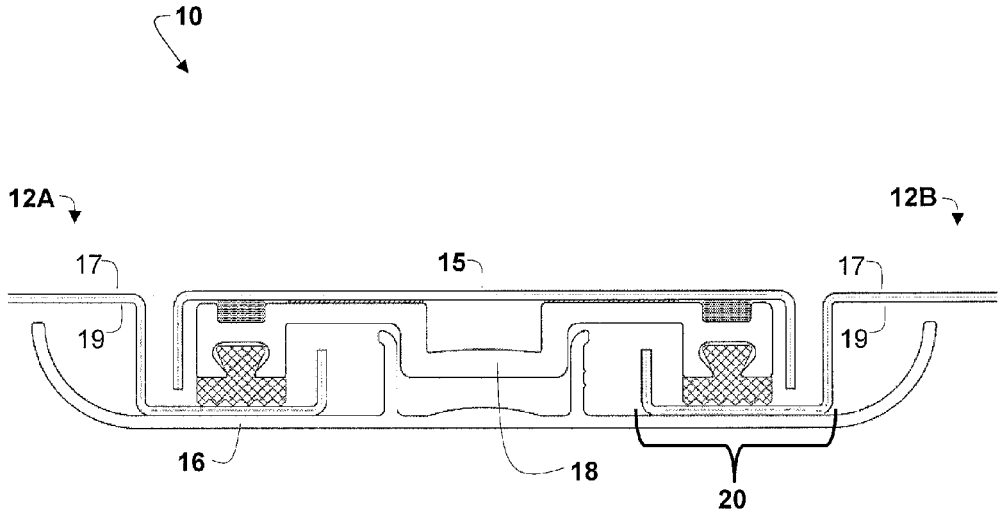

FIG. 2

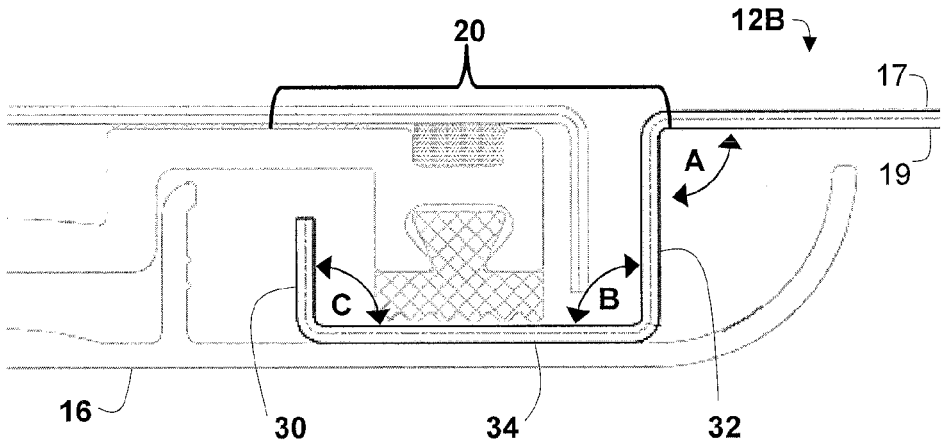

FIG. 3

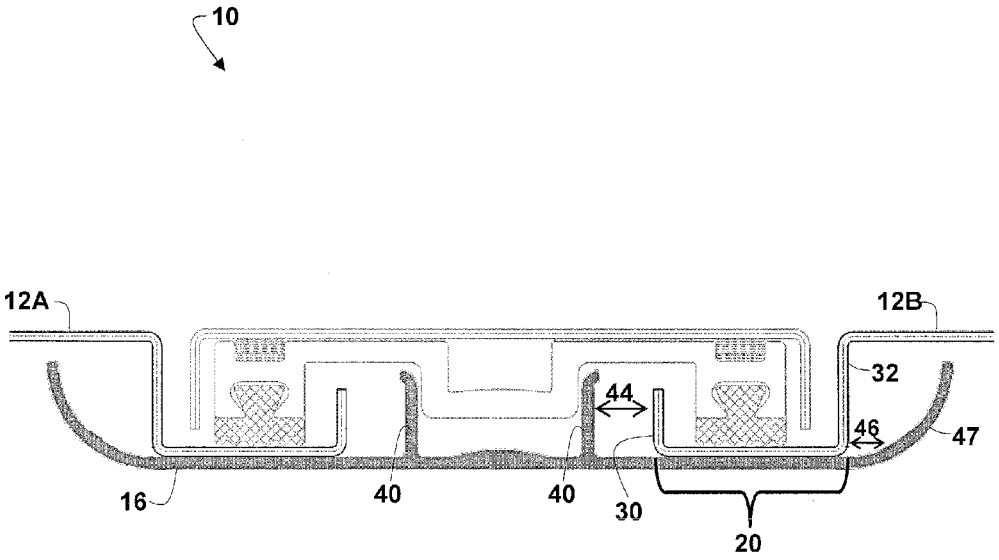

FIG. 4

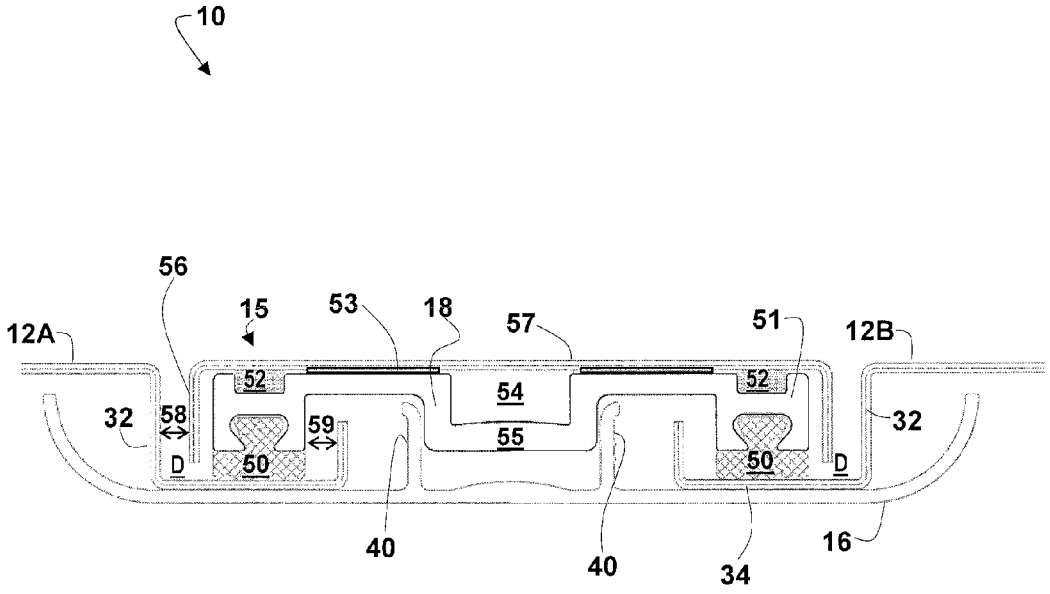
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FIG. 5

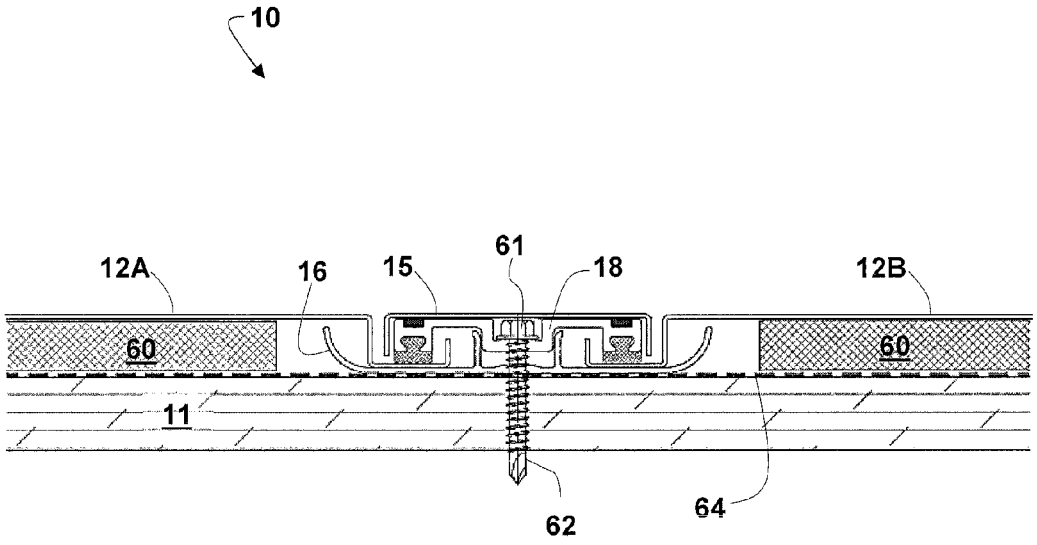

FIG. 6

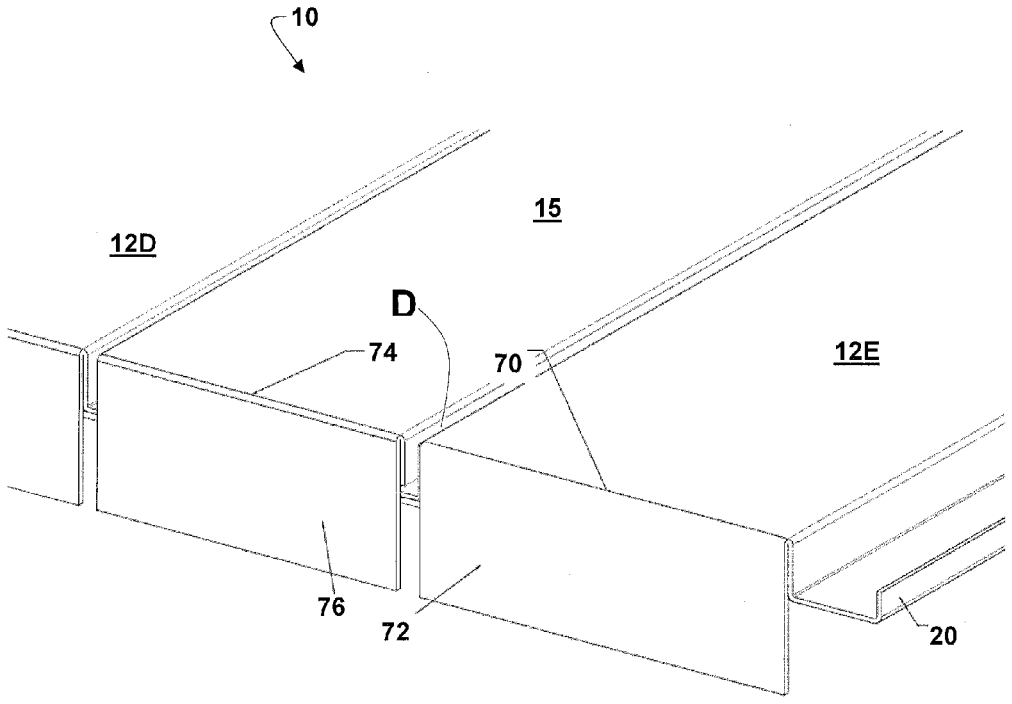

FIG. 7

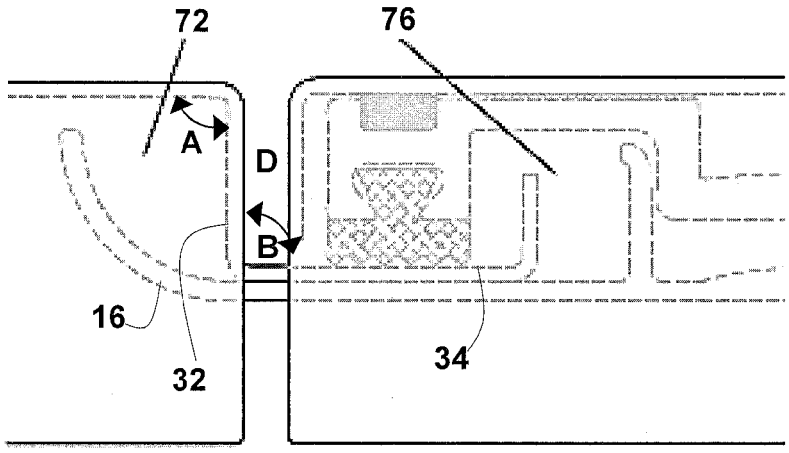

FIG. 8A

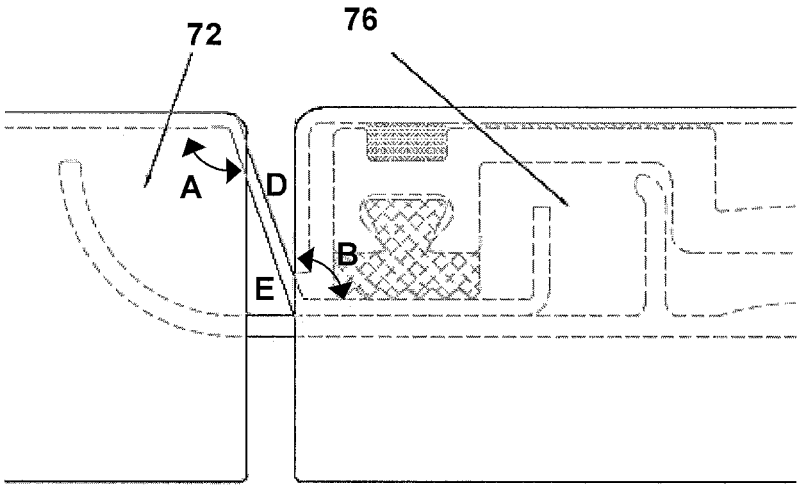

FIG. 8B

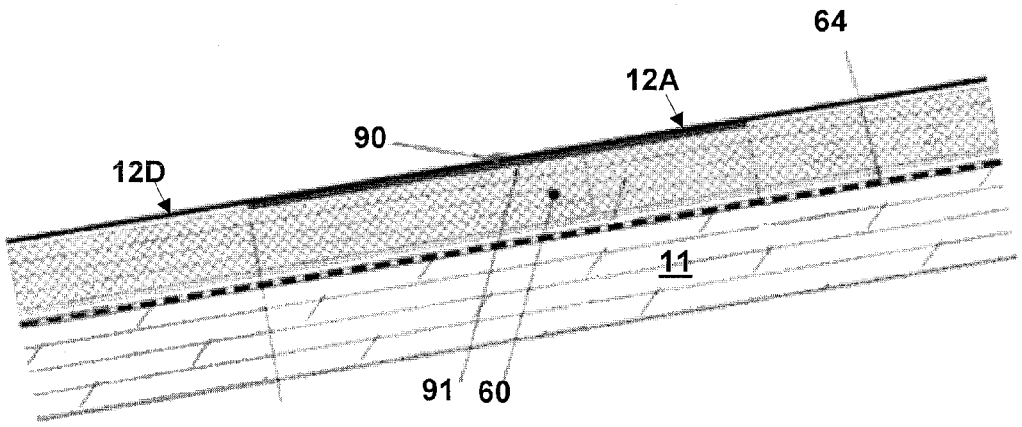

FIG. 9

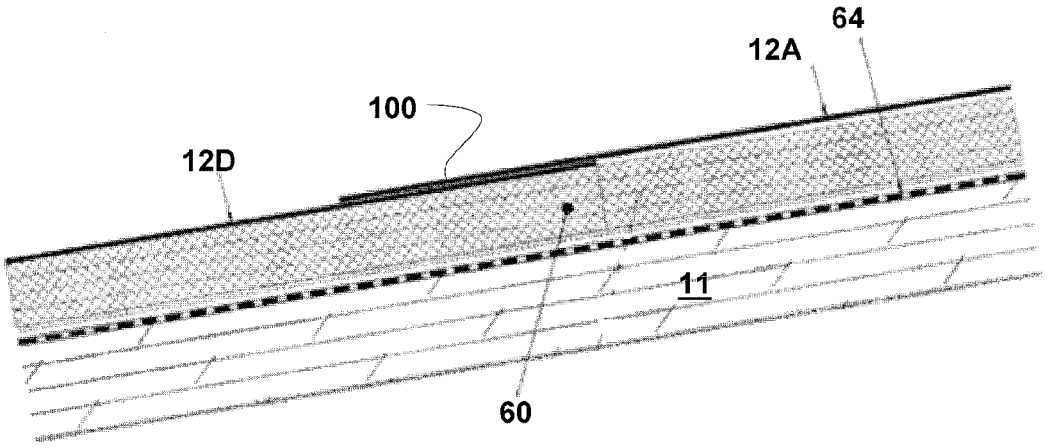

FIG. 10

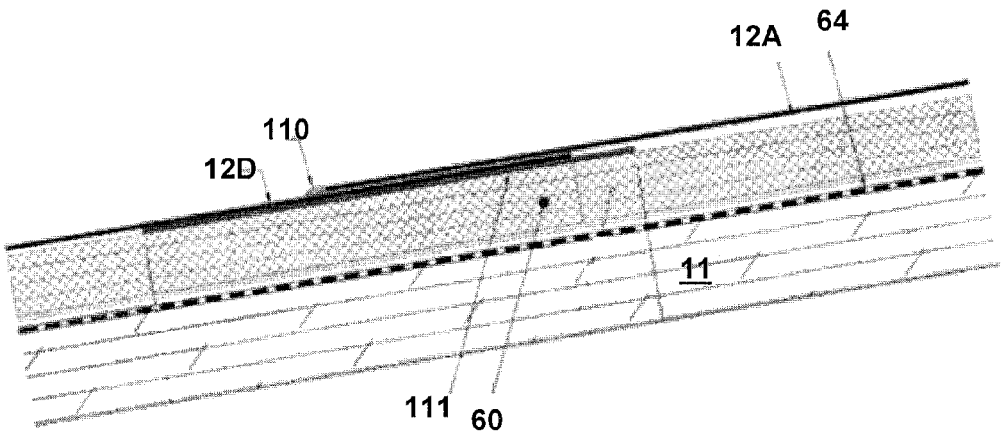

FIG. 11

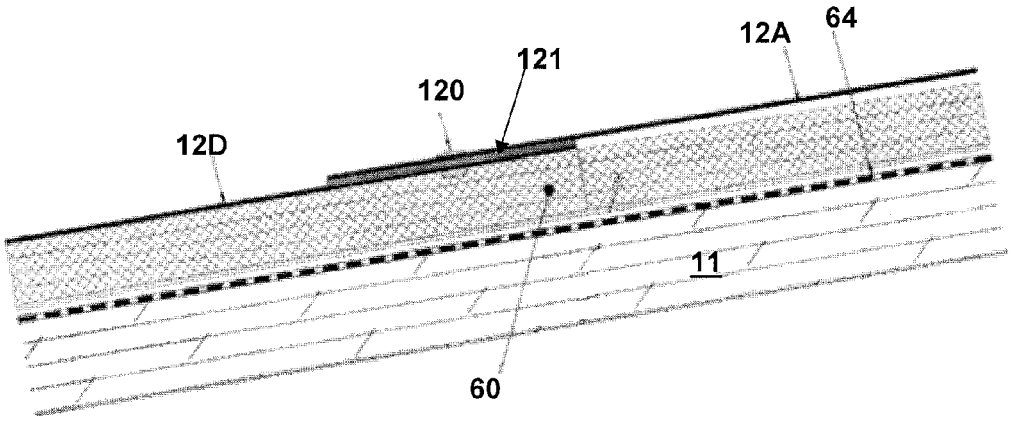

FIG. 12

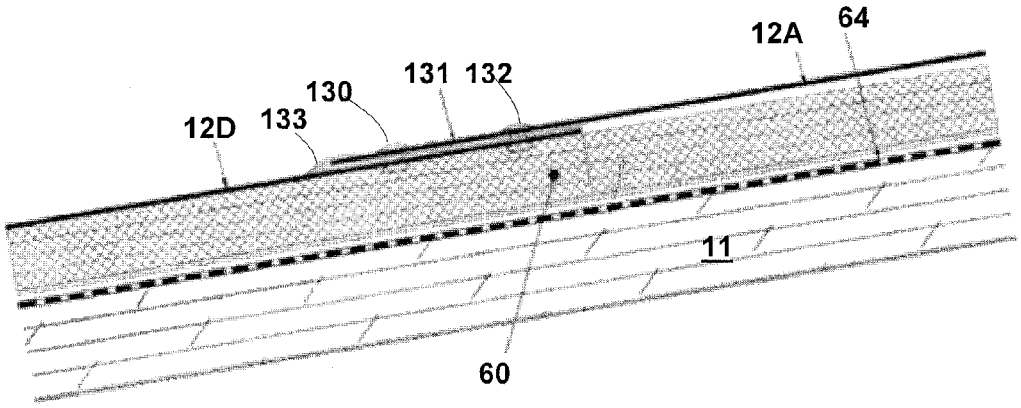

FIG. 13

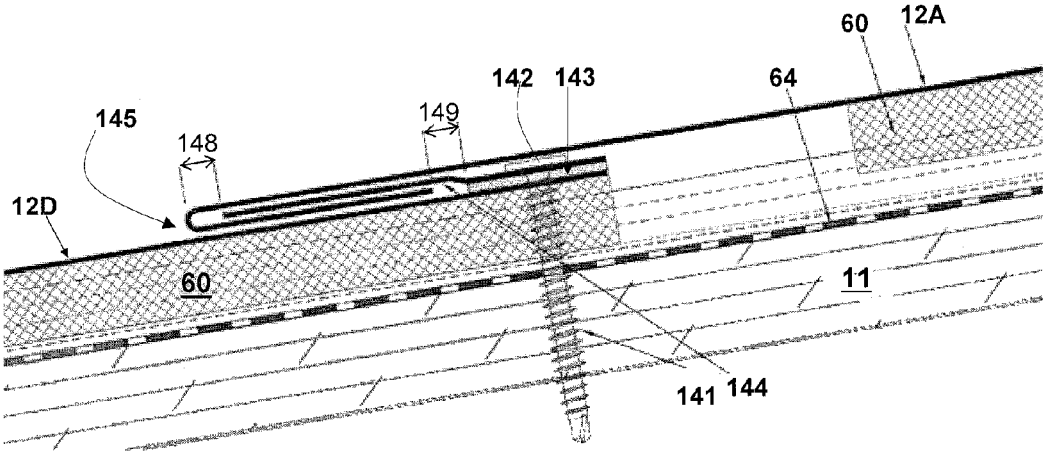

FIG. 14

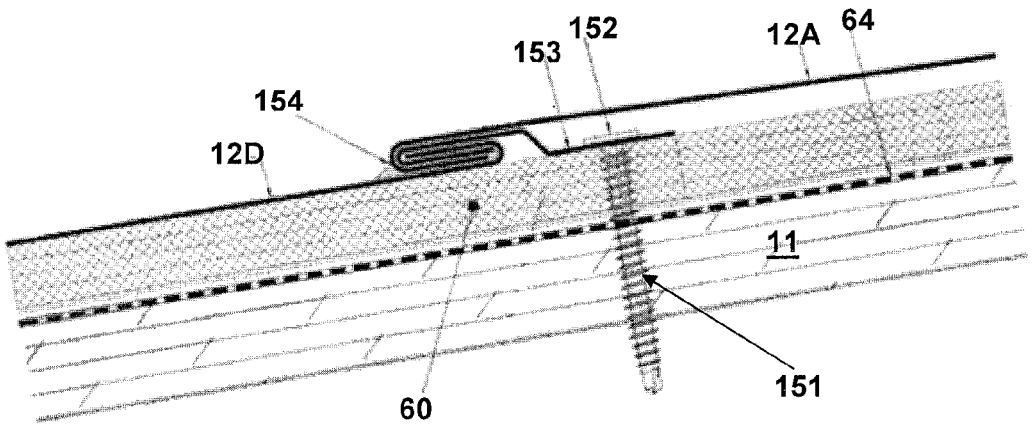

FIG. 15

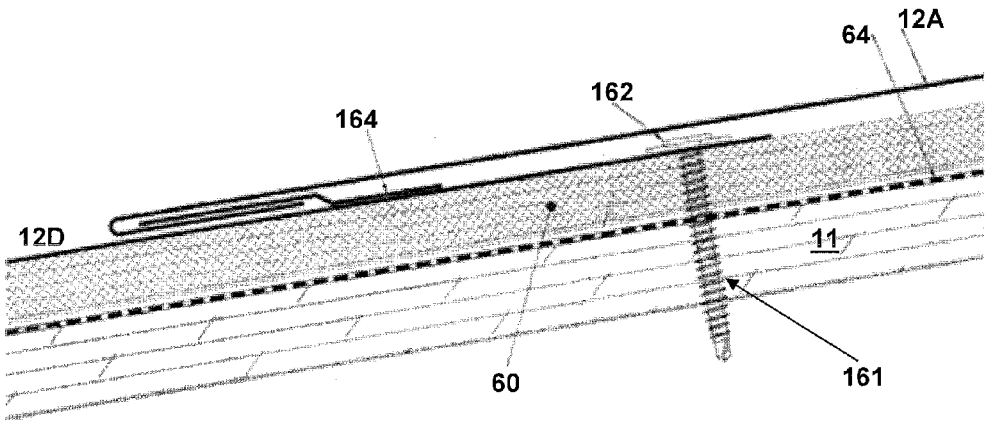

FIG. 16A

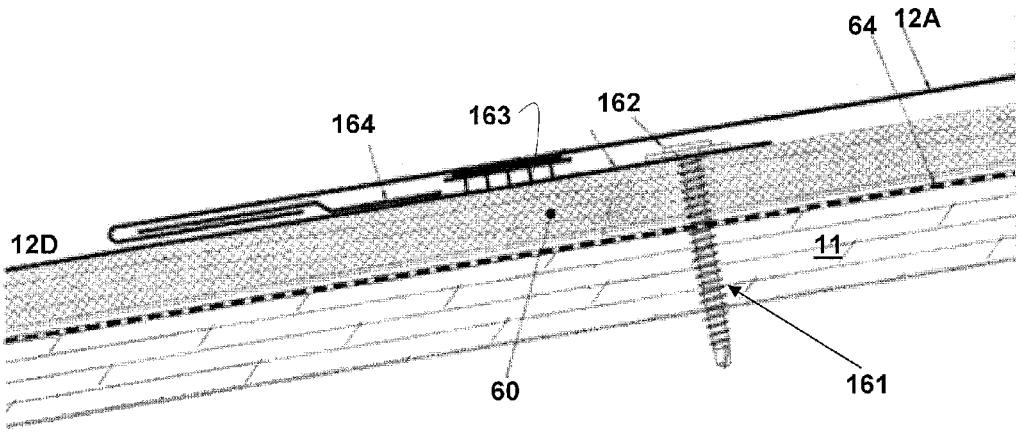

FIG. 16B

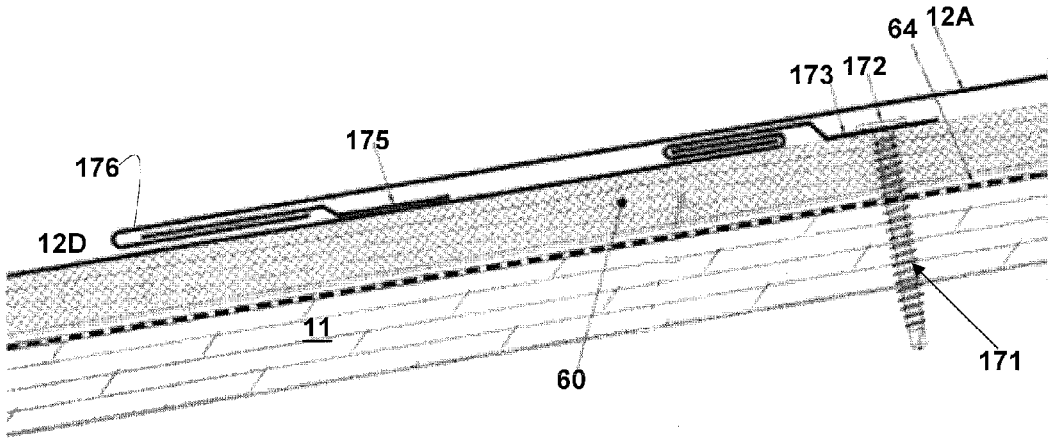

FIG. 17A

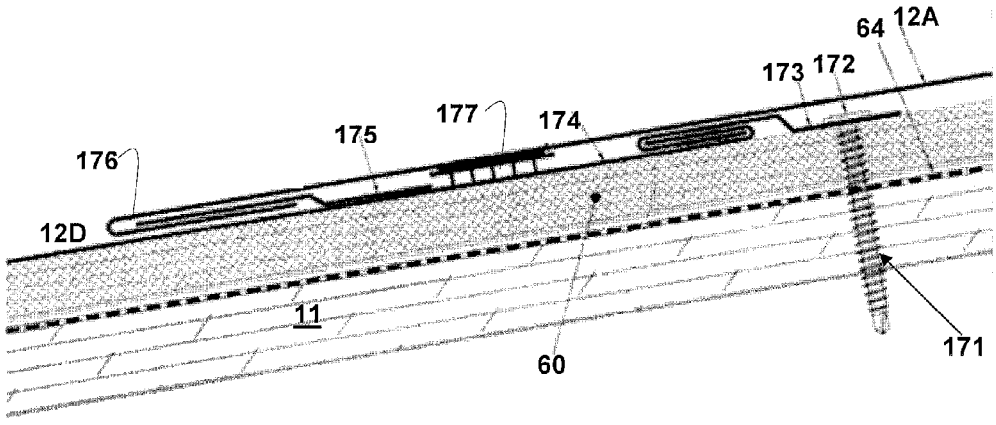

FIG. 17B

COVERING SYSTEM FOR A BUILDING SUBSTRATE

BACKGROUND

1. Technical Field of the Invention

This invention relates generally to a covering system for a building substrate. More specifically, the invention relates to a covering system which produces a surface having a smooth, planar configuration and which forms a watertight seal on and prevents virtually all water leakage into a building substrate. The system comprises panels having opposite, gutter shaped joints and a joint linking system which conceals both the drainage channels and the means for fastening the panels to the building substrate.

2. Description of the Related Art

Building covering systems have evolved over the years in an effort to improve weather-tightness and resistance to moisture damage as well as to increase insulation capacity. The lack of weather-tightness and poor insulation in roofing systems can be observed in colder climates as ice dams. That is, snow accumulation on a poorly insulated roofing structure frequently leads to ice buildup at the roofs edge. This ice buildup, known as an ice dam, causes water to buildup behind the ice which may lead to water damage of the building substructure, both at the roof line and within the supporting walls.

Panel systems designed to cover various building surfaces have been developed with the aim to reduce such damage. For example, metal panel systems have been developed which provide increased durability and weather resistance. Current metal panels used in roofing systems typically include panels having upstanding joint areas for linking the panels along adjacent margins, often referred to as standing seams. These standing seams can be secured by crimping, welding, interlocking, or soldering to prevent penetration of moisture to the back sides of the panels and the underlying building surface. These attachment points are rigidly fixed, however, and thermal expansion and contraction stresses which accumulate around these points often lead to wear and damage of the underlying building structure. Additionally, points where the panels are attached to the roof substrate also present areas which are vulnerable to moisture entry and consequent water damage.

Recent improvements to these metal panel systems have addressed some of these problems by fastening the panels to the building surface using a batten structure mounted within the joint area of adjacent panels, and by providing a cover which extends over the longitudinal margins and joint area of the adjacent panels. The batten and cover, however, are typically held in place by fasteners which limit expansion and contraction in at least one dimension in response to changes in the ambient temperature. Thus, while such systems provide a mechanism to conceal the attachment means and may allow for some movement, they still do not entirely solve all of the problems of thermal expansion and contraction stresses exerted on a panel system.

Accordingly, there exists a need in the art for a building covering system that may provide a water-tight seal on a building substrate, and which allows for thermal expansion and contraction in multiple dimensions. Further, there exists a need in the art for a building covering system that may increase the insulation value for a building.

SUMMARY

The presently disclosed invention overcomes many of the shortcomings of the prior art by providing a covering system for a building substrate which is weather-tight, has no exposed screws or fastening means, can expand or contract in multiple dimensions under varied environmental conditions or during the installation process, and has channels which collect and carry away moisture which comes into contact with the covering system. Further, the covering system does not have raised battens or standing seams, and thus provides a monolithic appearance.

According to its major aspects, and briefly stated, the present invention includes a covering system for a building substrate comprising at least two panels, a joint linking system, and means for attaching the covering system to the building substrate.

In embodiments, each panel may have a top side and two opposite, gutter shaped joints, wherein sidewalls of each joint are formed at about 90 degrees to a base wall of the joint. The joint linking system may comprise a cleat configured to accept adjacent joints of the at least two panels, a compression cap configured to bridge the adjacent joints, and a cover cap having a top side, wherein the top side of the cover cap may be flush with the top sides of the at least two panels. The means for attaching the covering system to the building substrate may be at least one screw which attaches the compression cap and the cleat to the building substrate.

In embodiments, the sidewalls of each joint may be formed at about 90 degrees to the top side of the at least two panels so that the base wall of the joint and the top side of the panel are on parallel planes. Further, the cover cap may be configured to conceal the compression cap and the at least one screw of the attachment means.

In embodiments, the compression cap comprises a top and a bottom surface, at least two gaskets on the bottom surface which form a watertight seal with a portion of the base wall of each of the adjacent joints of the at least two panels, at least two grooves on the top surface configured to receive sealant material, and a central channel. Sealant material may be placed in the at least two grooves on the compression cap to secure the cover cap and provide a watertight seal between the inner surface of the cover cap and the compression cap. The cleat may further comprise two upright flanges formed at about 90 degrees to a base of the cleat, wherein the central channel of the compression cap is received in the space between said flanges. Further, the central channel on the compression cap may be configured to accept the at least one screw of the attachment means.

In embodiments, the cleat may be sized to allow lateral movement of the adjacent joints of the at least two panels within the cleat. As such, during assembly of the covering system on a building substrate, the panels may be pulled apart or pushed closer together within the cleat to provide size flexibility during construction. After the system is fully assembled and water-tight, changes in weather conditions may cause the panels of the covering system to expand and contract, and the cleat of the present invention allows for such movement without undue stress on the panels or damage to the watertight joint linking system.

In yet further embodiments, the covering system may comprise at least two insulation sheets, wherein each insulation sheet is placed between the building substrate and one of the at least two panels.

In certain embodiments, the covering system may be composed of sheet metal, such as aluminum, stainless steel, titanium, zinc, or copper.

In other embodiments, the panels of the covering system may be roof or wall panels and the building substrate may be a roofing substrate or a wall substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

Aspects, features, benefits and advantages of the embodiments herein will be apparent with regard to the following description, appended claims, and accompanying drawings. In the following figures, like numerals represent like features in the various views. It is to be noted that features and components in these drawings, illustrating the views of embodiments of the present invention, unless stated to be otherwise, are not necessarily drawn to scale.

FIG. **1** illustrates a partial plan view of an exterior building surface utilizing the covering system in accordance with certain aspects of the presently disclosed invention;

FIG. **2** illustrates a sectional view taken along line **2-2** of FIG. **1** showing the covering system in accordance with certain aspects of the presently disclosed invention;

FIG. **3** illustrates a partial sectional view as in FIG. **2** pointing out the edge profile of the covering system in accordance with certain aspects of the presently disclosed invention;

FIG. **4** illustrates a sectional view as in FIG. **2** pointing out various parts of the drain channel of the covering system in accordance with certain aspects of the presently disclosed invention;

FIG. **5** illustrates a sectional view as in FIG. **2** pointing out various parts of the compression cap and cover cap of the covering system in accordance with certain aspects of the presently disclosed invention;

FIG. **6** illustrates a sectional view as in FIG. **2** showing assembly of the covering system on a building substrate in accordance with certain aspects of the presently disclosed invention;

FIG. **7** illustrates a perspective view showing the bent ends of the cover cap and panels at the eaves of a roofing substrate in accordance with certain aspects of the presently disclosed invention;

FIGS. **8**A and **8**B illustrate a sectional view as in FIG. **2** showing the bent ends of the cover cap and panels of the covering system in accordance with certain aspects of the presently disclosed invention, where FIG. **8**A shows the panel joint formed with about 90 degree angles and FIG. **8**B shows the panel joint formed at angles other than 90 degrees; and

FIG. **9**-FIG. **17**B illustrate a sectional view taken along line **9-9** of FIG. **1** showing the covering system of various embodiments in accordance with certain aspects of the presently disclosed invention.

DETAILED DESCRIPTION

In the following description, the present invention is set forth in the context of various alternative embodiments and implementations involving a covering system for a building substrate.

Various aspects of the covering system may be illustrated by describing components that are coupled, attached, and/or joined together. As used herein, the terms "coupled", "attached", and/or "joined" are interchangeably used to indicate either a direct connection between two components or, where appropriate, an indirect connection to one another through intervening or intermediate components. In contrast, when a component is referred to as being "directly coupled", "directly attached", and/or "directly joined" to another component, there are no intervening elements shown in said examples.

Relative terms such as "lower" or "bottom" and "upper" or "top" may be used herein to describe one element's relationship to another element illustrated in the drawings. It will be understood that relative terms are intended to encompass different orientations of aspects of the covering system for a building substrate in addition to the orientation depicted in the drawings. By way of example, if aspects of the covering system shown in the drawings are turned over, elements described as being on the "bottom" side of the other elements would then be oriented on the "top" side of the other elements as shown in the relevant drawing. The term "bottom" can therefore encompass both an orientation of "bottom" and "top" depending on the particular orientation of the drawing.

Referring now to the drawings, embodiments of a covering system for a building substrate of the present invention are shown in FIGS. **1-17** generally designated by the reference numeral **10**. FIG. **1** illustrates a partial plan view of a building surface covered by an embodiment of the covering system of the presently disclosed invention. Typically, such a building surface may be an exterior surface, such as an exterior wall or roof. The covering system **10** may, however, also be used on any interior building surface where exposure to moisture or water is a concern such as, for example, in a shower, bathroom, kitchen, or wet room. The building surface may be covered by a substrate **11** such as plywood, drywall, or any other material to which the covering system **10** may be attached. Alternatively, the building surface **11** may be a series of exposed beams, studs, or trusses to which the covering system **10** may be attached. In such an arrangement, an intermediate layer of building material may be placed between the beams, studs or trusses to provide for additional insulation, weather-tightness, and/or structural support.

The covering system **10** may comprise at least two panels **12** (shown as panels **12**A-**12**E in FIG. **1**) which may be joined at adjacent edges (such as the edges between panels **12**A and **12**B) by a joint linking system **14**, and may overlap at opposite edges (such as the edges between panels **12**A and **12**D) to form a seam **13**. The seam **13** may be formed with a bottom edge of an upper panel (such as panel **12**A or **12**B) overlapping a top edge of a lower panel (such as panel **12**D or **12**E) so that moisture may roll over the seam. Further, the joint linking system **14** may extend longitudinally to connect joints on adjacent panels or series of panels, as is shown in FIG. **1**. That is, the joint linking system **14** may be longer than the panels **12** so that one joint linking system **14** may connect several panels **12** on a building substrate **11**.

FIG. **2** illustrates a sectional view taken along line **2-2** of FIG. **1** showing the covering system in accordance with certain aspects of the presently disclosed invention. Each panel (**12**A, **12**B) may have a top side **17** which faces away from the building substrate and a bottom side **19** which faces toward the building substrate. Further, each panel (**12**A, **12**B) may have two opposite, gutter shaped joints **20** which protrude from the panel's bottom side **19**. Joints **20** from adjacent panels (**12**A, **12**B) may be connected by a joint linking system (shown as reference number **14** in FIG. **1**) comprising a cleat **16**, a compression cap **18**, and a cover cap **15**. More specifically, the joints of adjacent panels (**12**A, **12**B) may be positioned within the cleat **16** and covered by a combination of the compression cap **18** and the cover cap **15**.

As shown in FIG. **3**, each joint **20** of a panel **12**B may be formed with a base wall **34** and two upstanding sidewalls (**30**, **32**). The first and second side walls (**32**, **30** respectively) may be formed at an angle (B, C) of about 90 degrees relative to the base wall **34**. Further, the first sidewall **32** may be formed at an angle (A) of about 90 degrees relative to the panel body. Such an arrangement provides a base wall **34** which may lie parallel to a bottom portion of the cleat **16**, and which may be on a plane parallel with a top portion **17** of the panel (**12**B). In embodiments of the covering system of the presently dis-

closed invention, the angles A, B and C are defined as "about 90 degrees" or "about right angles", terms which may be used interchangeably. Further, use of the qualifier "about" is meant to indicate that the angle may vary from 90 degrees by +5%, or may be between 85 degrees and 95 degrees. In a preferred embodiment, the angles A, B and C may be 90 degrees.

During installation of the covering system **10** on a building substrate **11**, no specific means for attachment of the joints **20** directly onto the cleat **16**, such as bonding agents, glue, sealants, or the like, may be needed or used. As will be discussed below, attachment means may be placed on a central portion of the cleat **16** and the compression cap **18** (see FIG. **6**) which may hold the panels **12** to the building substrate **11**. Environmental changes, such as changes in the temperature or humidity, may cause the panels to expand or contract. Since no specific bonding agents may be used at the contact points between the joints **20** and the cleat **16**, small amounts of movement may be allowed to occur. This may reduce the wear and stress on the panels, but will not reduce the weathertightness of the covering system of the presently disclosed invention.

As shown in FIG. **4**, the cleat **16** may further have two centrally located upright flanges **40**. These flanges **40** may be formed at an angle of about 90 degrees relative to a base portion of the cleat **16**. Further, the cleat **16** may be proportioned to expansively accommodate the joints **20** from two adjacent panels (**12**A and **12**B). That is, the cleat **16** may be sized so that the joints **20** have space (**44** and **46**) within which to move laterally. The space **46** between the first sidewall **32** and the edge of the cleat **47** and the space **44** between the second sidewall **30** and the flange **40** allows the joint **20** to have lateral movement within the joint linking system. This lateral movement may allow for expansion and contraction of the panels **12** during assembly of the covering system **10** and in the course of environmental changes once installed on a building substrate.

While the flanges **40** are shown in FIG. **4** to be formed at about 90 degrees relative to a base portion of the cleat **16**, any other angle is possible and within the scope of the present invention. Furthermore, as shown in FIG. **4**, the space **46** within which a joint **20** may move laterally is limited by the upwardly curving sides **47** of the cleat **16**. In certain embodiments, the sides **47** of the cleat **16** may be formed at a defined angle relative to the base portion of the cleat such as, for example, about 90 degrees.

As shown in FIG. **5**, the joint linking system may also comprise a compression cap **18** and a cover cap **15**. The compression cap **18** may be configured to bridge and fit within the joints **20** (see FIG. **4**) of the two panels (**12**A, **12**B). Further, the compression cap **18** may comprise at least two gaskets **50** on a bottom surface which may form a watertight seal with a portion of the base wall **34** of each adjacent joint. These gaskets **50** may be secured onto the compression cap **18** by any means known in the art. For example, as shown in FIG. **5**, a top portion of the gaskets **50** may be shaped so that they fit within a comparably shaped groove on a bottom side of an end portion **51** of the compression cap **18**. Alternatively, the gaskets may be attached to a bottom side of the end portions **51** of the compression cap **18** using glue or any other fastening means known in the art.

The compression cap **18** may also comprise a central channel **55** which may be configured to fit within and between the upright flanges **40** of the cleat **16**. Further, the central channel **55** may be configured to accept at least one attachment or fastening means for attaching the covering system **10** to a building substrate. For example, the central channel **55** may comprise at least one hole sized to fit the shank of a screw or nail. Attachment of the covering system **10** to the building substrate may be achieved by driving the screw or nail through the compression cap **18** via the hole and then through the cleat **16** into the building substrate. In embodiments, the cleat **16** may be configured to accept at least one attachment or fastening means. That is, the cleat **16** may also have at least one hole sized to fit the shank of a screw or nail.

The holes of the cleat **16** and the compression cap **18** may be spaced to coincide in relative position during installation of the joint linking system so that the screw or nail may be driven through the respective holes in the compression cap **18** and cleat **16** into the building substrate. The holes may be sized to accommodate various dimensions of attachment means. Further, the holes may allow for movement (expansion/contraction) of the joint linking system in the course of environmental changes once installed on a building substrate. That is, the holes may be shaped as slots so that movement may occur in at least one direction, or may be larger than the size of the attachment means so that movement may occur in multiple directions. In the latter case, if the hole is sized larger than the head of the attachment means, such as the head of the screw or nail, a washer may be used to secure the attachment means. Such variation in attachment means would be known by one having ordinary skill in the art. In certain embodiments, washers may be included to provide additional moisture protection. For example, washers may be control seal washers, self-sealing washers, rubber or neoprene washers.

Further, the space **54** formed between the cover cap **15** and the central channel **55** of the compression cap **18** may be sized to contain a top portion of the fastening or attachment means such as the head of a screw or nail. Thus, once the cover cap **15** is installed over the compression cap **18**, both the compression cap **18** and any exposed portions of the fastening or attachments means (e.g., screw or nail heads, washers) used to secure the covering system **10** to the building substrate may be entirely concealed from view.

The cover cap **15**, which conceals the attachment means, may be comprised of a top portion or panel **57** having two sidewalls **56** extending therefrom. The two sidewalls **56** may extend from edges of the top panel **57** which are adjacent to the joints **20** of the panels (such as panels **12**A and **12**B) when the cover cap **15** is installed. As shown in FIG. **1**, the joint linking system **14**, which includes at least the cleat **16**, the compression cover **18**, and the cover cap **15**, extends longitudinally with respect to the joints **20** of the adjacent panels.

An inner surface of the top panel **57** of the cover cap **15** may be securely attached to the compression cap **18** using a sealant such as, for example, a moisture proof sealant. As such, the compression cap **18** may have an additional set of channels **52** on a top side of the end portion **51** which may accept a sealant material. This sealant material may be applied within the channel **52** during installation of the covering system **10** onto a building substrate. In embodiments, the sealant may provide a watertight seal between the cover cap **15** and the compression cap **18**, and may thus restrict water or moisture from entry to the attachment means used in the central channel **55**.

Further, to facilitate installation of the cover cap **15** onto the compression cap **18**, a top side of the compression cap **18**, or an inner surface of the top panel **57** of the cover cap **15**, may have a double sided tape **53** or other means for rapid and at least temporary attachment of the cover cap **15** to the compression cap **18**. This attachment means may aide in holding the cover cap **15** in place over the compression cap **18** during the period before the sealant in the compression cap channels **52** is cured.

Upon installation, the cover cap **15** may be flush or coplanar with the panels **12**A and **12**B. As such, the covering

system **10** produces a surface having a smooth, planar configuration. The compression cap **18** and cover cap **15** may be sized to provide space (**58** and **59**) in which they may move laterally within the joints of the panels (**12**A and **12**B). As mentioned above, this lateral movement may allow for expansion and contraction of the panels during assembly and in the course of environmental changes once installed. Further, the space **58** between the first sidewall **32** of the joint, and the gasket **50** and end portion **51** of the compression cap **18** provides a channel D within which moisture may be carried away from the covering system **10**.

Referring now to FIG. **5** and FIG. **6**, a method of installing the covering system **10** will be described. A building substrate **11** may be covered with a water resistant or waterproof barrier or membrane **64**. A cleat **16** may be position on the waterproof barrier **64** or directly on the building substrate **11**. Insulation sheets **60** may be arranged on either side of the cleat **16**. These insulation sheets **60** may be overlaid with panels (**12**A, **12**B) so that the joints from adjacent panels are positioned within the cleat **16**. The panels (**12**A, **12**B) conceal and protect the insulation sheets **60**. A compression cap **18** may be positioned over the cleat **16** with the central channel **55** fitting within the space between the two upright flanges **40**. This may aid in holding the panels **12**A and **12**B, and cleat **16** in place. Fastening or attachment means **62**, such as a nail or screw, may now be driven through the coincident holes on the compression cap **18** and cleat **16**, and into the building substrate **11**. Installation of the fastening or attachment means may compress the gasket **50** of the compression cap **18** against the base of the joint, and thus may provide for improved weather tightness of the covering system **10**.

Prior to installation of the cover cap **15**, waterproof sealant may be deposited in the channels **52** which lie on the top side of the compression cap **18**. A double sided tape which is initially adhered to either the underside of the cover cap **15** or the top side of the compression cap **18** may be uncovered or exposed and may aid in holding the cover cap **15** in place on the compression cap **18** until the sealant cures. Once the sealant cures, there should be no regions on the building substrate **11** that may come into contact with moisture. Further, any moisture that may accumulate on the covering system **10** will be directed to the channels D (shown in FIG. **5**) and will be guided away from the building surface.

With continued reference to FIG. **6**, the insulation panels **60** may be generally rectangular boards of standard thickness, and may be formed of any material known in the art. For example, the insulation panels **60** may be covering boards made of lightweight foam such as foamed expanded polystyrene, foamed polyisocyanurate, or foamed polyurethane. Other exemplary materials for the insulation panels **60** include fiberglass, mineral wool, cellulose board, cement board, plywood or oriented strand board. Each panel may be of any standard length, width, or thickness known in the art. In an exemplary embodiment, the insulation panels **60** may be formed of ¼ to ½ inch thick closed cell polyisocyanurate foam. Further, the insulation panels **60** may be sized to fit under a panel **12** between the opposite gutter shaped joints, and may be shorter than, the same length as, or longer than the panel **12** in a longitudinal direction (that is, in the region between seams **13** as shown in FIG. **1**). The insulation boards **60** may be provided cut to size. Alternatively, and in order to expedite the use of the insulation board **60** by personnel installing the building covering system, the boards may be easy to cut to size so that building surfaces having non-standard configurations may be accommodated.

Other attributes of the insulation panels **60** may depend of the building substrate to which the covering system is to be attached. For example, insulation panels **60** which may be used on a roofing substrate may need to have higher compression strength than those which are used for a wall or soffit application. Roofing applications may benefit from insulation panels having compression strengths of 80 PSI or greater so that loads placed on the covering system during maintenance do not compress or dent the insulation panels **60**. Insulation panels **60** used in wall and soffit applications would not be exposed to the same maintenance loads and, as such, may only need to have compression strengths of 20 PSI or greater. Further, insulation panels **60** having mold resistance according to ASTM D3273 may be advantageous in areas exposed to moisture.

In all applications, light weight, fire resistance, water resistance, mold resistance and low water absorption properties are advantageous features of any insulation board **60** selected for the covering system of the presently disclosed invention. In the event that an insulation board is selected which does not have these properties, such as plywood or oriented strand board, the waterproof or water resistant barrier or membrane **64** may be placed over the insulation board **60** and the panels **12** and joint linking system **14** may be installed over that. Further, materials used for the insulation boards **60** may be treated to impart these qualities. Exemplary insulation board **60** materials providing one or more of the aforementioned qualities include at least Firestone ISOGARD™ HD cover board, Firestone DensDeck® cover board, Firestone FiberTop cover board, Johns Mansville Invinsa® FR Roof Board, and Hunter H-Shield HD

In embodiments where this covering system **10** may need to end at an edge such as, for example, a roof edge or eave, the panels **12** and the cover cap **15** may be bent at the point where the covering system meets the edge. As shown in FIG. **7**, each panel **12**E may be bent along an edge **70** so the end of each panel covers the edge of the building substrate. The bent portion **72** of each panel **12**E may have any length needed to cover at least a portion of the building substrate edge. Further, the cover cap **15** may be bent along an edge **74** so the end of the cover cap covers the end of the building substrate. Similarly, the bent portion **76** of the cover cap **15** may have any length needed to cover at least a portion of the building substrate edge. The remaining portion of the joint linking system **14** (the cleat **16**, compression cap **18**, and joints **20**, as shown in FIG. **2**) remains unbent and extends to the edge of the building substrate at a point just prior to the bend edge **74** of the cover cap **15**. That is, the cleat **16**, compression cap **18**, and joints **20** remain unbent and the respective ends of these components that extend to the edge of the building substrate are also covered by the bent portion **76** of the cover cap **15**.

The bend **70** in the panel **72** and the bend **74** in the cover cap **76** may be the same or different, and may be any angle required to cover an end of a specific building substrate. For example, the cover cap **15** and panel **12**D or **12**E may be bent to an angle of about 90 degrees, as is shown in FIG. **7**.

As shown in FIG. **7**, a space or gap exists between the bent ends of the panels (**72** for panel **12**E) and the bent end of the cover cap **76**. This gap corresponds to the channel D shown in FIG. **5** which allows any moisture that may accumulate on the covering system **10** to be directed away from the building surface. In embodiments, this gap (channel D) is not covered by the bent ends of the panels (**72** for panel **12**E) and the cover cap **76**. Further, with reference to FIG. **8**A, the selection of about 90 degrees for angles A and B allows channel D to be formed in such a manner that moisture which accumulates in the channel D is directed away from the covering system unimpeded. That is, moisture that may collect on the covering system may accumulate in channel D and may exit from the

edge of the channel unimpeded by the bent regions of the panels **72** or the cover cap **76**. This last benefit is advantageous in situations where the covering system is used as a roofing system. In the event that debris which falls or blows onto the roofing system accumulates in channel D, as is the case with standard house gutters, this material will be readily cleared from the channel by the action of gravity and/or moisture.

If the angles A and B are selected to be greater than about 90 degrees, as is shown in FIG. **8**B, a portion of channel D may be covered by the bent portion of the cover cap **76** and such debris may gather at this point. Further, an additional internal channel E may be formed which could allow entry of moisture and/or debris into an unsealed region of the covering system. Extending the width of the bent portion of the panel **72** would close this internal channel E, but may also occlude the external channel D which is needed to direct accumulated moisture and debris away from the covering system.

Another advantage to the selection of about 90 degrees for the angles A, B and C (as shown in FIGS. **3** and **8**A) is evident upon installation of the covering system on a building substrate. During installation, the about 90 degree angles allow for increased lateral tolerances per panel width. That is, the installer has some flexibility during the installation process on how close each panel may be placed with respect to the next panel. This may increase productivity and reduce costs of installation. After installation, the increased tolerances reduce the risk of leaks or damage to the covering system caused by environmental changes, such as changes in the temperature or humidity, which may cause the panels to expand or contract.

Further, the selection of about 90 degrees for the angles A, B and C (as shown in FIGS. **3** and **8**A) provides a more aesthetically pleasing product once installed on a building substrate. As is evident from the illustration in FIGS. **7** and **8**A, there are no visible joints or internal sections at a building substrate edge. When angles A and B are other than about 90 degrees, as is shown in FIG. **8**B, there are exposed internal sections which are visible and may detract from the aesthetic quality of the installed cover system.

In use, the panels **12** may be installed in end-to-end or end-over-end overlapping configurations at predesigned spaced intervals along a building surface (see for example seams **13** of FIG. **1**). The ends may be attached and made more moisture resistance through the use of various end-linking systems which are illustrated in FIGS. **9**-**17**B, each of which illustrate the same sectional view of the building covering system taken along line **9**-**9** of FIG. **1**. In each of the following figures, the building surface **11** is shown to be covered by a water resistant barrier or membrane **64** and at least one insulation board **60**. As mentioned above, the water resistant barrier or membrane **64** may alternatively be placed over the insulation board **60**, or may be omitted.

FIG. **9** illustrates a simple configuration for attachment of the longitudinal ends of the panels (shown as **12**A and **12**D), which may be abutted over the insulation board **60**. The panels may be soldered or welded to provide a solid, waterproof, and permanent connection (shown as solder or weld point **90**). In cases where welding is used, a layer of fire retardant paper **91**, such as a cellulose fire retardant paper, may be included directly under the solder or weld point **90** in order to protect the insulation board **60** and other panel components during the welding process. In an exemplary embodiment, the layer of fire retardant paper **91** may be about 4 inches wide and may extend the full length of weld. Alternatively, several portions of fire retardant paper **91** may be used to provide the correct wide and length required to protect the insulation board **60** and other panel components during the welding process

FIG. **10** illustrates an alternative configuration for the attachment of the longitudinal ends of the panels **12**A and **12**D, wherein a first panel **12**A in overlaid upon a second panel **12**D. The amount of overlap **100** between the two panels may depend on several factors, including at least the location of installation of the building covering system and the size of the space to be covered by the building covering system. In an exemplary embodiment, the two panels may overlap by about 2 inches. Further, and as shown in FIG. **11**, the overlap region of the two panels **12**A and **12**D may be welded to provide a solid, waterproof, and permanent connection (shown as solder or weld point **110**). As mentioned above, a layer of fire retardant paper **111**, such as a cellulose fire retardant paper, may be included under the weld point **110** in order to protect the insulation board **60** and other panel components during the welding process. Any other means for connection of the two panels **12**A and **12**D in the overlap region (**100** of FIG. **10**) known in the art is within the scope of the present invention, such as various adhesive tapes, glues, caulks or sealants.

As shown in FIG. **12**, the overlap region may be connected via a single cinch lock, spot weld, solder, screw, nail, or rivet **120**. As shown, panel **12**A overlaps panel **12**D, and the two panels are connected by a rivet **120**. The region of overlap between the two panels may be made more waterproof or weather tight by the addition of a sealant, glue, caulk or tape **121**. Alternately, a very high bond ("VHB") tape may be used alone or in combination with the connection means (screw, nail, or rivet **120**). Moreover, more than one connection means may be used, such as rivets **130** and **132** shown in FIG. **13**. As shown in FIG. **13**, the region of overlap between the two panels may be made more waterproof or weather tight by the addition of a sealant, glue, caulk or tape **131** alone or in combination with a more extensive weld or solder region **133**.

As shown in FIG. **14**, each panel **12** may have one bent edge or end **145** adjacent to the gutter shaped joints. This bent edge **145** (shown as an end of panel **12**A) may be secured to a corresponding hook **144**, which may be attached to an adjacent panel (shown as an end of panel **12**D). During installation of the covering system **10**, the hook **144** may be attached to a lower panel **12**D using any attachment means known in the art, such as a screw **141**, rivet or nail. A gasket **143** may be placed between the hook **144** and the portion of the lower panel **12**D to which the hook **144** is to be attached to provide a more water-tight seal for the screw **141** on the panel **12**D. The bent edge **145** of the upper panel **12**A may then be secured over the hook **144**. An upward bend in the hook **144** may be formed to allow space for the upper panel **12**A end and/or space for the top of the fastening means **142**.

The hook **144** may be placed at any position on the lower panel, such as at an upper end as shown for panel **12**D in FIG. **14**. For ease of installation, however, the hook **144** may be placed away from the end of the panel so that various building surface sizes may be more easily accommodated. That is, standard length panels may be used in situations where panels of a slightly shorter length would be needed. The hook **144** may be placed away from the edge of the panel by a distance that may essentially shorten the panel once installed on the building surface **11**.

The bent edge **144** and the hook **145** may be sized to provide spaces **148** and **149**. These spaces (**148**, **149**) may allow for movement of the upper panel **12**A with respect to the lower panel **12**D during installation and in the course of environmental changes once installed on a building substrate

11. Sealant may be used at the contact points between the hook **144** and the inside of the bent edge **145** of the upper panel **12**A. Alternately, a weld or solder point may be placed at the region between the bent edge **145** of the upper panel **12**A and the lower panel **12**D (not shown).

The hook **144**, which is attached to an end of the lower panel **12**D, may be attached using a screw **141** which may be driven through the hook **144**, gasket **143**, panel **120**, insulation panel **60**, and into the building substrate **11**. As mentioned above, a weather-tight barrier layer **64** may be included between the building substrate **11** and the insulation panels **60**. Such a barrier may be any type of barrier known in the art such as a waterproof membrane (plastic or rubber), paper sheeting, foils, etc.

As shown in FIG. **15**, both the upper panel **12**A and the lower panel **12**D may have bent edges adjacent to the gutter shaped joints. In certain embodiments, the bend in the edge of the upper panel **12**A may cause the end of the panel to fold under with respect to the building surface, while the bend in the edge of the lower panel **12**D may cause the end of the panel to fold upward with respect to the building surface. In such an arrangement, the two bent edges may be secured or hooked together as shown in FIG. **15**. To more securely attach the panels to the building surface, a separate hook **153** may be secured over the bent end of the lower panel **12**D and may be attached directly to the insulation board **60** using any attachment means known in the art, such as a screw **151**, rivet or nail. The bent end of the upper panel **12**A may then be secured over the hook **153** and bend end of the lower panel **12**D. Sealant may be used at the contact points of the hook **153**, the bent edge of the upper panel **12**A, and the bent edge of the lower panel **12**D. Alternately, a weld or solder **154** may be placed at the region between the bent edge of the upper panel **12**A and the lower panel **12**D. An upward bend in the hook **153** may be formed to allow space for the upper panel **12**A end and/or space for the top of the fastening means **152**.

Shown in FIG. **16**A is a configuration for attachment of the longitudinal ends of the panels **12**A and **12**D which is a slight variation of the arrangement shown in FIG. **14**. Specifically, the hook **164** may be attached to a point on the lower panel **12**D which is below the point at which the lower panel **12**D is attached to the insulation board **60** and building substrate **11**. Attachment of the hook **164** to the lower panel **12**D may be by via a single cinch lock, spot weld, solder, screw, nail, rivet or any combination thereof. An end of the lower panel **12**D may then be attached to the insulation board **60** and building substrate **11** using any fastening means known in the art such as, for example, a screw **161**. The screw **161** may be made weather tight on the lower panel **12**D by placing a gasket or washer between the screw head **162** and the lower panel **12**D. The bent edge of the upper panel **12**A may then be secured over the hook **164**.

With continued reference to FIG. **16**A, an upward bend in the hook **164** may be formed to allow space for the upper panel **12**A end and/or space for the top of the fastening means **162**. Further, the upward bend in the hook **164** may allow space for a gasket **163**, as shown in FIG. **16**B, in the region of connection between the upper panel **12**A and the lower panel **12**D. Inclusion of a gasket **163** may improve the weather and/or water tightness of the connection between the two panels.

Shown in FIG. **17**A is a further alternative configuration for attachment of the longitudinal ends of the panels **12**A and **12**D. As shown in FIG. **17**A, a first hook **175** may be attached to a point on the lower panel **12**D which is below the point at which the lower panel **12**D is attached to the insulation board **60** and building substrate **11**. This attachment may be by via a single cinch lock, spot weld, solder, screw, nail, rivet or any combination thereof. An end of the lower panel **12**D comprising a bent edge may then be secured to a second hook **173** which may be attached to the insulation board **60** and building substrate **11** using any fastening means known in the art such as, for example, a screw **171**. The screw **171** may be made weather tight on the lower panel **12**D by placing a gasket or washer between the screw head and the lower panel **12**D.

With continued reference to FIG. **17**A, the bent edge **176** of the upper panel **12**A may then be secured over the first hook **175**. An upward bend in the both the first hook **175** and the second hook **172** may be formed to allow space (**174** of FIG. **17**B) for the upper panel **12**A end and/or space for the top of the fastening means **172**. Further, the upward bend may allow space **174** for a gasket **177**, as shown in FIG. **17**B, in the region of connection between the upper panel **12**A and the lower panel **12**D. Inclusion of a gasket **174** may improve the weather and/or water tightness of the connection between the two panels.

In certain embodiments, any combination of the above mentioned connection means as shown in FIGS. **9-17** may be used to connect one panel to another, and/or may be used alone or in combination to connect all of the panels along seams **13** of FIG. **1** in the building covering system of the presently disclosed invention.

The covering system **10** of the presently disclosed invention is preferably employed for exterior cladding such as roofs and walls. This system, however, is versatile and may be employed for architectural details such as columns, or for anchoring interior panels as well. Further, the panels can be curved and/or tapered for barrel vaults and domes or spherical shapes. The system is the exterior exposed component of a building surface composite assembly.

As shown in FIG. **1**, embodiments of the covering system of the present invention produce a surface having a smooth, planar configuration. Further, the covering system forms a watertight seal on and prevents water leakage into a building substrate. Water or moisture that does accumulate on the covering system is collected in drainage channels (region labeled D in FIG. **5**) which direct the moisture away from the building surface. Since the drainage channels are open at each end of a joint linking system, multiple connected panels may form a single extended channel which may direct the moisture away from the surface of a building.

An exemplary embodiment of the covering system **10** of the present invention may have panels **12** of sheet metal construction of 10 to 26 gauge. For example, the sheet metal may be stainless steel of 20 to 26 gauge, aluminum of 16 to 20 gauge, copper of 10 to 20 ounce, zinc of 20 to 24 gauge, and titanium of 24 to 26 gauge. Other metals such as, for example, galvanized steel or brass, or any suitable metal or synthetic resin material are also within the scope of the present invention.

The panels **12** are preferably of generally rectangular shape; however the ends or sides nearest an end or edge of a building surface may be tapered to various other shapes such as, for example, a trapezoidal shape, for special architectural applications. The panels may be roll formed in 20 to 40 foot (6.1 to 12.2 meter) lengths. In especially preferred embodiments, the panels **12**, cleat **16**, compression cap **18**, and cover cap **15** may be of unitary construction, although spot welding of components may be employed.

Several representative dimensions for an exemplary covering system **10** will be described below with reference to FIG. **5**. The panels **12** and cover cap **15** may be composed of a metal as described above having a thickness of about 0.04 inches, and may be painted or protected with a surface coating

or finish. The cleat **16** and compression cap **18** may be composed of a lightweight aluminum formed by a channel extrusion process. The cover cap **15** may have a diameter of about 2.75 inches, with downward sloping sides **56** which are about 0.4 inches in length. Thus, an exemplary insulation board **60** would be a single ½ inch board or two layers of a ¼ inch board.

With continued reference to FIG. **5**, the compression cap **18** may have a diameter of about 2.54 inches, which is smaller than the diameter of the cover cap **15**, and thus provides tolerance to facilitate installation. Further, the spaces **58** and **59** shown in FIG. **5** provide additional tolerances to facilitate installation and are the result of the width of the gutter shaped joint **20**, generally about 0.76 inches, which is larger than the width of the end portion **51** of the compression cap **18**, generally about 0.39 inches.

While specific embodiments of the invention have been described in detail, it should be appreciated by those skilled in the art that various modifications and alternations and applications could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements, systems, apparatuses, and methods disclosed are meant to be illustrative only and not limiting as to the scope of the invention.

What is claimed is:

1. A covering system for a building substrate, comprising:

at least two panels, wherein each of the panels comprises a top side and two opposite, gutter shaped joints, wherein the joints have two sidewalls formed at about 90 degrees to a base wall;

a cleat configured to accept adjacent joints of the at least two panels;

a compression cap configured to bridge the adjacent joints;

a cover cap having a top side, wherein the top side of the cover cap is sh with the top sides of the at least two panels; and

means for attaching the covering system to the building substrate,

wherein the cleat is sized to allow lateral movement of the adjacent joints of the at least two panels within the cleat.

2. The covering system for a building substrate of claim **1**, wherein the means for attaching the covering system to the building substrate includes at least one screw which secures the compression cap and the cleat to the building substrate.

3. The covering system for a building substrate of claim **1**, wherein the sidewalls of each joint are formed at about 90 degrees to the top side of the panel so that the base wall of the joint and the top side of the panel are on parallel planes.

4. The covering system for a building substrate of claim **1**, wherein the cover cap conceals the compression cap and the means for attaching the covering system to the building substrate.

5. The covering system for a building substrate of claim **1**, further comprising at least two insulation sheets, wherein each insulation sheet is placed between the building substrate and one of the at least two panels.

6. The covering system for a building substrate of claim **1**, wherein the at least two panels are composed of sheet metal.

7. The covering system for a building substrate of claim **1**, wherein the compression cap comprises:

a top surface and a bottom surface;

at least two gaskets on the bottom surface which form a watertight seal with a portion of the base wall of each of the adjacent joints of the at least two panels;

at least two grooves on the top surface configured to receive a sealant material; and

a central channel.

8. The covering system for a building substrate of claim **7**, wherein the sealant material placed in the at least two grooves on the compression cap secures the cover cap and provides a watertight seal between an inner surface of the cover cap and the compression cap.

9. The covering system for a building substrate of claim **7**, wherein the cleat comprises two upright flanges formed at right angles to a base of the cleat, wherein the central channel of the compression cap is received in the space between the flanges of the cleat.

10. The covering system for a building substrate of claim **7**, wherein the central channel of the compression cap is configured to accept the means for attaching the covering system to the building substrate.

11. A covering system for a roofing substrate, comprising:

at least two roof panels, wherein each of the roof panels comprises a top side and two opposite, gutter shaped joints, wherein the joints have two sidewalls formed at about 90 degrees to a base wall;

a cleat configured to accept adjacent joints of the at least two roof panels;

a compression cap configured to bridge the adjacent joints, the compression cap having:

a top surface and a bottom surface,

at least two gaskets on the bottom surface which form a watertight seal with a portion of the base wall of each of the adjacent joints of the at least two roof panels,

at least two grooves on the top surface configured to receive a sealant material, and

a central channel;

at least one screw which secures the covering system to the roofing substrate by attaching the compression cap and the cleat to the roofing substrate; and

a cover cap having a top side with an inner surface and sidewalls formed at about 90 degrees to the top side, wherein the top side of the cover cap is flush with the top sides of the at least two roof panels,

wherein the central channel of the compression cap is configured to accept the at least one screw, and the sealant material placed in the at least two grooves on the compression cap secures the cover cap and provides a watertight seal between the inner surface of the cover cap and the top surface of the compression cap.

12. The covering system for a roofing substrate of claim **11**, wherein the sidewalls of each joint are formed at about 90 degrees to the top side of the at least two roof panels so that the base wall of the joint and the top side of the roof panel are on parallel planes.

13. The covering system for a roofing substrate of claim **11**, wherein the cover cap conceals the compression cap and the at least one screw.

14. The covering system for a roofing substrate of claim **11**, wherein the cleat comprises two upright flanges formed at about 90 degrees to a base of the cleat, wherein the central channel of the compression cap is received in the space between said flanges.

15. The covering system for a roofing substrate of claim **11**, wherein the cleat is sized to allow lateral movement of the adjacent joints of the at least two panels within the cleat.

16. The covering system for a roofing substrate of claim **11**, further comprising at least two insulation sheets, wherein each insulation sheet is placed between the roofing substrate and one of the at least two roof panels.

17. The covering system for a roofing substrate of claim **11**, wherein the at least two roof panels are composed of sheet metal.

18. A covering system for a building substrate, comprising:

at least two panels, wherein each of the panels comprises a top side and two opposite, gutter shaped joints, wherein the joints have two sidewalls formed at about 90 degrees to a base wall;

a joint linking system which connects the at least two panels at adjacent joints; and

means for attaching the covering system to the building substrate along the joint linking system, wherein the joint linking system provides a weather-tight seal on the building substrate,

wherein the joint linking system is sized to allow lateral movement of the adjacent joints of the at least two panels,

wherein the joint linking system lies flush with the top sides of the at least two panels.

19. The covering system of claim 18, wherein the joint linking system comprises:

a cleat configured to accept the adjacent joints of the at least two panels;

a compression cap configured to bridge the adjacent joints; and

a cover cap having a top side, wherein the top side of the cover cap is flush with the top sides of the at least two panels, wherein the cover cap conceals the compression cap and the means for attaching the covering system to the building substrate.

20. The covering system of claim 19, wherein the means for attaching the covering system to the building substrate includes at least one screw which secures the compression cap and the cleat to the building substrate.

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